

County of Maui Drought Mitigation Strategies

Prepared for:

Maui Drought Committee

and

State of Hawaii

Department of Land and Natural Resources
Commission on Water Resource Management

Prepared by:

Wilson Okamoto Corporation
Engineers and Planners
1907 South Beretania Street
Honolulu, Hawaii 96826

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The following individuals from various federal, State, and county agencies, and private organizations contributed to this report:

Robert Collum, County of Maui Civil Defense Agency, (808) 270-7285
John Cumming, Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife, (808) 984-8108
Lance DeSilva, DLNR Division of Forestry and Wildlife, (808) 873-3501
Harold Edwards*, Molokai Ranch, (808) 660-2883
Sumner Erdman, Ulupalakua Ranch, (808) 878-1202
Ranae Ganske, U.S. Department of Agriculture (USDA) Natural Resources Conservation Service, (808) 244-3100 x107
Robert Granger, Molokai Irrigation System Water Users' Advisory Board, and the Hawaii Farm Bureau Federation – Molokai
Garret Hew, East Maui Irrigation Company and Hawaiian Commercial & Sugar Company, (808) 579-9516
Joloyce Kaia, Hana Soil & Water Conservation District
Collins Lam, Lanai Water Company, (808) 565-3352
Robert Lum, Department of Agriculture, (808) 973-9473
Doug MacCluer, Central Maui Soil and Water Conservation District
George Maioho*, Department of Hawaiian Home Lands, Molokai District, (808) 560-6104
Vanessa Medeiros, Department of Hawaiian Home Lands, Maui District, (808) 760-5121
Jeff Pearson, County of Maui Department of Water Supply, (808) 270-7834
James Robello, USDA Farm Services Agency, (808) 244-3100 x2
Glenn Shishido, DLNR Division of Forestry and Wildlife, (808) 873-3501
Rex Takushi, County of Maui Fire Department, (808) 270-7561
Warren Watanabe, Hawaii Farm Bureau Federation
Edwin Young, Nahiku-Hana Farmer
Warren Suzuki, Wailuku Agribusiness, (808) 877-3882

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1 INTRODUCTION

As part of a statewide effort to address and mitigate the effects of natural hazards, the County of Maui has undertaken the development of strategies to mitigate the effects of drought. Drought is one of the most obstinate and pernicious of natural disasters which at its most severe form decimates crops and livestock, erodes the landscape, damages terrestrial and aquatic wildlife habitat, contributes to widespread wildfire, and results in hundreds of millions of dollars in damage. Drought moves slowly and manifests after months of below normal precipitation, and recovery requires much more than one good rainfall. Drought results from both climatic conditions and from human activities that increase demand for water.

Drought can lead to tough decisions regarding allocation of water, stringent water-use limitations in large urban areas, problems in ensuring safe drinking water and adequate water supplies for fire fighting efforts. In the past, drought was addressed as a temporary emergency. Actions were taken in response to impacts in a reactionary fashion. The most important lesson learned in recent years is that the best time to reduce the impacts of drought is before they occur. Therefore, it is important to develop a plan that advocates a proactive drought management approach. The County of Maui Drought Mitigation Strategy was developed with this approach in mind.

This report presents the mitigation strategies developed by the Maui Drought Committee as a result of workshops that were held on June 30 and July 19, 2004. The State Commission on Water Resource Management (CWRM), in cooperation with the State Civil Defense (CD), received Federal Emergency Management Agency (FEMA) assistance to develop county drought mitigation strategies. Workshops were undertaken to compile an inventory of existing drought mitigation programs, identify data gaps, identify drought risk areas, and recommend and prioritize drought mitigation projects. The Maui Drought Committee has decided it will continue to meet regularly and earnestly work towards implementing the mitigation projects identified during the workshops.

2 BACKGROUND

The preparation of County Drought Mitigation Strategies is a part of a larger statewide drought-planning framework. Statewide drought planning is guided by the *Hawaii Drought Plan* (HDP), which was most recently updated in 2004. In addition, drought mitigation planning is incorporated into the forthcoming *State of Hawaii Hazard Mitigation Plan* and each of the respective *County Multi-Hazard Mitigation Plans*.

2.1 Hawaii Drought Plan

The *Hawaii Drought Plan* provides a coordinated and consistent program and framework for integrating federal, State, county and private sector actions to reduce drought impacts. The plan is intended to serve as a working guide for those agencies and private entities that have the capabilities and resources to develop drought response and mitigation programs within their areas of jurisdiction.

The HDP includes a description of historical drought occurrences, current monitoring programs by federal, State and local agencies, climatological statistics, and risk assessments of susceptibility and vulnerability to drought. The plan emphasizes the identification of pre- and post- drought preparedness and mitigation measures for implementation by government agencies, stakeholders, and the general public.

The HDP recognizes County/Local Drought Committees (CLDCs) as integral elements for effective implementation of drought planning and mitigation. The plan anticipates that CLDCs will be the first to identify drought effects, be responsible for initial implementation of mitigation activities, and generally be the first to respond to and manage public health, safety and fire related issues.

2.2 State of Hawaii Hazard Mitigation Plan

To meet the requirements of the Disaster Management Act of 2000 and the planning guidelines by the Federal Emergency Management Agency, the State Department of Defense, Civil Defense Division is preparing the *State of Hawaii Hazard Mitigation Plan*, as well as plans for each of the four counties. At the time of this writing, the completion of the plan was anticipated by December 2004.

The Federal Disaster Management Act of 2000 requires each state and territory to conduct hazard mitigation planning and to implement projects to reduce hazard impacts prior to a disaster occurrence. This Act marked a fundamental shift in policy. Rather than placing primary emphasis on response and recovery, FEMA's focus broadened to incorporate mitigation as the foundation of emergency management.

Future funding for public assistance subsequent to disasters will be largely contingent upon mitigation plan completion. Additionally, states are required to have an

approved Standard State Mitigation Plan in order to receive additional Pre-Disaster Mitigation funds for state or local mitigation projects after November 1, 2004.

The Standard State Mitigation Plan will also be required for non-emergency assistance provided under the Stafford Act, including Public Assistance restoration of damaged facilities and Hazard Mitigation Grant Program funding. A state with a FEMA-approved Enhanced State Mitigation Plan at the time of a disaster declaration is eligible to receive increased funds under the Hazard Mitigation Grant Program, based on 20 percent of the total estimated eligible Stafford Act assistance. Therefore, the development of state and local hazard mitigation plans is key to maintaining eligibility for future FEMA mitigation and disaster recovery funding.

The *State of Hawaii Hazard Mitigation Plan* will encompass the broadest possible scope of disaster occurrences, focusing on nine natural hazards: hurricanes, tsunami, earthquakes, floods, volcanic eruptions and lava flow, coastal erosion, landslides, wildfire, and drought. Several of these hazard categories have current advisory boards or task forces that will be developing recommendations and strategies.

It is anticipated that some of the drought mitigation projects identified by CLDCs will be incorporated into the county and State hazard mitigation plans, thereby allowing these areas to be eligible for future assistance from FEMA.

2.3 County Multi-Hazard Mitigation Plan

The Disaster Mitigation Act of 2000 also requires the development of local or county plans for that particular county to be eligible for post-disaster funding. The purpose of these requirements is to ensure that there are local programs and projects in place that will help minimize the loss of life, property, and total cost of disasters.

Similar to the *State of Hawaii Hazard Mitigation Plan*, the county plans have been designed as multi-hazard mitigation plans. The initial *County Multi-Hazard Mitigation Plans* did not detail specific drought mitigation projects.

2.3.1 County Drought Mitigation Strategies

In order to develop county-specific drought mitigation strategies, the Commission on Water Resource Management conducted a series of workshops within each county. The resulting county-specific drought mitigation strategies, which are documented in this report, can be incorporated into each *County Multi-Hazard Mitigation Plan*. Formulation of these mitigation strategies resulted in the development of specific project proposals, which are documented in this *Drought Mitigation Strategies* report. The county can then choose to seek funding for these projects through FEMA or other sources. The CLDC will have the lead role in implementing projects identified

in their *Drought Mitigation Strategy* and may seek assistance from the State Civil Defense Division, the Hawaii Drought Council, and the State Drought Coordinator.

The primary objectives of the county workshops were to establish standing CLDCs and improve the coordination and implementation of local drought mitigation and response actions. The CLDCs play a key role in Hawaii's drought leadership structure by providing directives and allowing for stakeholder representation at the county/local level. Improved coordination and project implementation will arise from better communication between government agencies and the private sector, from enhanced monitoring and data collection, and through the development of immediate and near-term drought mitigation strategies.

The expected outcomes of the county workshops included the following:

1. Identification of current mitigation measures and existing data gaps in drought information/planning;
2. Development and prioritization of county-based drought mitigation strategies, including ranking criteria for project selection and identification of priority mitigation projects which may be eligible for agency funding;
3. Transition from “emergency response” to early “proactive” mitigation;
4. Improved post-drought impact assessment; and
5. Validation of drought response/mitigation measures.

3 MAUI DROUGHT COMMITTEE

3.1 Membership and Leadership

The Maui County/Local Drought Committee (hereafter referred to as “Maui Drought Committee”) is comprised of representatives from key governmental agencies, non-governmental organizations, and major landowners with an active interest in drought-related issues. Based on participation in the drought workshops, the present membership includes the following agencies and entities:

- Maui Civil Defense Agency
- Maui Department of Water Supply
- Maui Fire Department
- Department of Agriculture
- Department of Hawaiian Home Lands, Maui District
- Department of Hawaiian Home Lands, Molokai District
- Department of Land and Natural Resources, Division of Forestry and Wildlife
- US Department of Agriculture, Farm Service Agency
- US Department of Agriculture, Natural Resource Conservation Service
- Maui Soil and Water Conservation Districts

- East Maui Irrigation Company and Hawaiian Commercial and Sugar Company
- Hawaii Farm Bureau Federation
- Lanai Water Company
- Molokai Irrigation System
- Molokai Ranch
- Ulupalakua Ranch

Representatives participated in workshop sessions held in June and July 2004 and shared local knowledge and information about current drought conditions, and past experiences coping with drought. Through facilitated discussion, the group collectively developed local and regional drought mitigation strategies to minimize the effects of drought upon domestic and municipal water supplies, fire suppression activities, agricultural water use, and the environment.

Committee members participating in the workshops generally agreed that this is a worthwhile effort deserving of continuation. Committee members selected Mr. Doug MacCluer to chair the Maui Drought Committee.

3.2 Relationship to State Drought Leadership

The *Hawaii Drought Plan* establishes a drought leadership structure that, in addition to the County/Local Drought Committees, consists of the Hawaii Drought Council, the State Drought Coordinator, and the Water Resources Committee. The purpose of each of these groups/entities and their relationship to the Maui Drought Committee is as follows:

Hawaii Drought Council. The Hawaii Drought Council is the steering group that oversees the statewide coordination of drought-related activities. The Drought Council currently functions within existing agency authorities and responsibilities, and facilitates access to services and/or assistance to lessen the impacts of drought.

The Drought Council serves as the liaison between the various entities involved with drought planning/response, including the Maui Drought Committee and the Office of the Governor. It also assumes the lead role in intergovernmental drought response coordination and media information releases.

State Drought Coordinator. The State Drought Coordinator is responsible for coordinating drought-related actions and communications between federal, State, and county agencies, stakeholders, and the general public. The State Drought Coordinator position resides in the Commission on Water Resource Management.

The State Drought Coordinator will serve as the principal liaison between the Maui Drought Committee, the Hawaii Drought Council, Water Resources Committee, and other government agencies.

Water Resources Committee. The Water Resources Committee monitors all available climatological data, reservoir storage levels, ground water conditions, weather forecasts and other pertinent information necessary to analyze the current status and forecasted level of drought conditions throughout the State.

Information gathered by the Water Resources Committee will be available to the Maui Drought Committee through the State Drought website and reports distributed by the State Drought Coordinator.

3.3 Role and Responsibilities

3.3.1 Coordination and Communication with Government Agencies and Stakeholders

The Maui Drought Committee will serve as a focal point for the exchange of information between federal, State, and county agencies, local stakeholders, and the Hawaii Drought Council. The Maui Drought Committee will be responsible for monitoring drought conditions, gathering data, and forwarding information to the Hawaii Drought Council via the State Drought Coordinator. In turn, the State Drought Coordinator will provide data gathered by the Water Resources Committee to the Maui Drought Committee for distribution to local agencies and stakeholders.

3.3.2 Data Collection and Drought Monitoring

The Maui Drought Committee is uniquely qualified to provide information on crop and livestock impacts, reservoir water levels, stream conditions, ground water levels, and other drought issues at the County level. The Maui Drought Committee should assist in monitoring ground water levels, stream/ditch conditions, and reservoir levels. The Maui Drought Committee should also monitor and assess current and potential impacts of impending or ongoing drought, focusing upon impacts to the local economy, the environment, and natural resources.

Following each drought event, the Maui Drought Committee should take the lead in conducting post-drought evaluations. Post-drought evaluations will assist in documenting statewide drought impacts and will serve to assess the effectiveness of specific response and mitigation measures implemented at both the State and county level. Upon development, the State Drought Coordinator will assist the Maui Drought Committee in applying a standardized methodology to document economic, environmental, and social drought impacts.

3.3.3 Mitigation Actions

Planning for drought mitigation activities is a key function of the Maui Drought Committee. Drought mitigation projects identified by the Maui Drought Committee are discussed in chapters 5 and 6 of this report. It is the responsibility of the Maui Drought Committee to carry out activities in pursuit of the following:

- Further refinement and/or delineation of areas of drought risk;
- Application, receipt and administration of funds for the implementation of identified projects; and
- Provision of oversight and management of project implementation.

The State Drought Coordinator, the Hawaii Drought Council, and the Water Resources Committee are available to provide the Maui Drought Committee with technical assistance and aid in the identification and acquisition of funds for project implementation. The Maui Drought Committee is also responsible for the periodic review and appropriate revision of county drought mitigation strategies, adding, deleting or refining projects to reflect changing circumstances and priorities.

3.3.4 Response Actions

During drought, the Maui Drought Committee will be responsible for initiating appropriate and coordinated drought response activities within the capabilities of local government agencies, and any State or federal drought programs. The Maui Drought Committee should advise the Hawaii Drought Council of any needs that cannot be met through existing Maui County resources. The Maui Drought Committee will be the point of contact for the State Drought Coordinator relative to providing drought information and seeking assistance for response actions and documentation of impacts. The activities of the Maui Drought Committee during drought periods should include the following actions:

- Meet quarterly (or more frequently) to discuss drought impacts and planned response actions;
- Monitor drought impacts and communicate this information to the Hawaii Drought Council via the State Drought Coordinator;
- Make recommendations as necessary for the issuance of county/local drought declarations in coordination with the Hawaii Drought Council and other Maui County offices and agencies; and
- Provide for outreach activities targeting affected stakeholders with the purpose of determining needs, identifying detailed emergency assistance response actions or projects, and requesting relief funding from the appropriate source with assistance from the State Drought Coordinator.

4 DROUGHT RISK AND VULNERABILITY FOR THE COUNTY OF MAUI

In September 2003, the Commission on Water Resource Management completed a statewide *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. The risk and vulnerability assessment illustrates the spatial extent and severity of drought risk for different impact sectors throughout the state. Areas in the County of Maui identified in the report as subject to drought risk are shown in the table below.

| County of Maui Drought Risk Areas | | | |
|---|---|--------------------------|----------------|
| Sector | Drought Stage | | |
| | Moderate | Severe | Extreme |
| Water Supply | Kula, Kahului, Wailuku, Hana, Lahaina | Kula, Hana | Kula |
| Agriculture and Commerce | Western Molokai, central/south Lanai | South Lanai | |
| Environment, Public Health & Safety (based on 12-month time scale) | Kula | Kula, Central Molokai | Kula |

Adapted from: Table 6.2 Drought Risk Areas for the Maui County, *Drought Risk and Vulnerability Assessment and GIS Mapping Project*, prepared for the State Commission on Water Resource Management, September 2003

The Maui Drought Committee examined the findings of the drought risk report and, through group discussion of areas of concern and drought impact sector issues, generated a revised list of specific geographic areas of the county that are most susceptible to drought. It was noted that Upcountry Maui (Kula, Makawao and Pukalani to Kaupo) and the western side of Molokai are particularly at risk to drought.

The table below summarizes the areas identified by the group as having the highest drought risk:

| Drought Risk Areas Identified by the Maui Drought Committee | |
|--|--|
| Impact Sector | Drought Risk Areas |
| Water Supply | Upcountry Maui (including Kula, Makawao, and Pukalani to Kaupo) Western part of Molokai |
| Agriculture | Central Maui Kahikinui Keokea Kula Ulupalakua Hoolehua (Molokai) Lanai (entire island) |
| Wildland Fire | Haleakala National Park Kahikinui Kihei Maalaea to Ukumehame Kula State Forest Reserve Ulupalakua Kawela Gulch and westward (Molokai) Lanai (entire island) |

5 EXISTING DROUGHT RESPONSE AND MITIGATION ACTIVITIES FOR THE COUNTY OF MAUI

The following sections summarize the existing drought response and mitigation efforts and programs in the County of Maui. “Drought response” refers to emergency actions that are implemented directly in response to drought conditions. “Drought mitigation” is defined as short- and long-term actions and/or programs that may be implemented prior to, during, and after drought events to reduce the degree of risk to human life, property, and the economy. Drought response and mitigation activities are presented for each of three impact sectors: Wildland Fire; Agriculture; and Water Supply. Challenges and issues related to these existing programs are also summarized.

5.1 Current Drought Response Activities

5.1.1 Wildland Fire Impacts

Presently, private landowners and the County of Maui Fire Department cooperate to respond to wildland fire. Private landowners may allow access and provide equipment to respond to wildland fire. However, there are no formal agreements between the Fire Department and private landowners regarding wildland fire response due to liability concerns. The State Department of Land and Natural

Resources' (DLNR) Division of Forestry and Wildlife (DOFAW) responds to wildland fire on State forested lands, and assists with fires on non-State lands at the request of the Maui Fire Department.

5.1.2 Agriculture and Commerce Impacts

During periods of drought, East Maui Irrigation Company (EMI) closely monitors ditch flow and allocates water to priority uses. Any water cutbacks by EMI are shared across all users. During drought periods on Molokai, the State Department of Agriculture allocates water from the Molokai Irrigation System depending on crop type.

The US Department of Agriculture (USDA) has post disaster programs that share with agricultural producers the cost of rehabilitating eligible farmlands damaged by natural disasters and provide emergency water conservation assistance. Normally, the funds are used for conservation practices and compensation for livestock and agricultural losses. Since 1999, nearly \$1,000,000 has been disbursed in Maui for drought related compensation.

5.1.3 Water Supply Impacts

Water Supply response actions are undertaken primarily by the County Department of Water Supply. For Upcountry Maui, the County of Maui, Board of Water Supply Resolution No. 98-18 outlines actions for the Department of Water Supply to implement for varying stages of drought. Response actions are based on ditch flows and reservoir levels. Actions include voluntary and mandatory use restrictions, public outreach activities, and operational controls.

During dry periods, the Department of Hawaiian Homelands (DHHL) also inserts notices in water billings requesting water conservation.

5.2 Current Drought Mitigation Activities

5.2.1 Wildland Fire Impacts

Wildland fire mitigation activities in the County of Maui are currently conducted by federal and State and local agencies. The USDA Natural Resources Conservation Service administers the Emergency Watershed Protection Program, which provides for the construction of firebreaks and reservoirs.

State and local mitigation activities include implementation of the national Firewise program which addresses wildland fire through public outreach and education. The County of Maui has also adopted an ordinance that requires landowners to construct firebreaks between the agricultural/rural and urban interface. The ordinance is enforced by the Maui Fire Department. Finally, the DHHL sends notices to tenants to clear and remove weeds from their assigned lots to reduce fuels and fires.

contractors to clear weeds from unassigned lots. The DHHL also invites the Maui Fire Department to attend DHHL association meetings to promote fire prevention awareness and outreach.

5.2.2 Agriculture and Commerce Impacts

Agriculture mitigation activities are primarily undertaken by private landowners. Maui Land and Pineapple Company, Inc. (MLP) has installed wells and 25 million gallons of surface water storage capacity. During periods of drought, the wells can provide 90 percent of MLP's water supply, however, the cost of power makes running the wells cost prohibitive except as an emergency backup.

On Molokai, many farmers have converted to drip irrigation, which has reduced water demand.

5.2.3 Water Supply Impacts

Water supply mitigation activities are undertaken by the Maui Department of Water Supply (DWS), Department of Hawaiian Home Lands and the Lanai Water Company.

In order to reduce water demand, the DWS conducts outreach and promotes xeriscaping for new developments. However, these activities are not included in a formal conservation program.

The DHHL has encouraged homesteaders to practice water conservation. Some residents have installed drip irrigation systems and set irrigation timers to go on during the evening to conserve water.

The Lanai Water Company has implemented a number of drought mitigation measures in the Manele and Koele areas. These measures include:

Manele

- Encouragement of xeriscaping for roadside landscaping.
- Compliance with homeowner covenant requiring brackish water (>250 ppm Cl) to be used for irrigation, low water demand plantings, and limits for irrigated areas.
- Installation of a dual water line system (potable and brackish).
- Compliance with the Maui County mandate requiring use of R1 or brackish water for golf course irrigation.

Koele

- Construction of a 22 MG reservoir to capture urban runoff for golf course irrigation.

- Planned revisions to the master drainage plan for improvements to pipe water from Koele to Manele.
- Installation of a floating cover for the water supply reservoir to reduce loss due to evaporation.

5.3 Existing Gaps in Drought Mitigation

The Maui Drought Committee reviewed presently available information supporting their drought mitigation efforts and identified gaps in data, related deficiencies and concerns, and offered suggestions for improvements. Mitigation projects were “brainstormed” for the geographic areas that the Committee had identified as being at risk to drought.

5.3.1 Wildland Fire Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to wildland fire drought impacts:

Recommendations for all risk areas in the County of Maui:

- Improve and expand fire education programs.
- Examine and expand the use of fuel breaks.
- Form a committee to examine the issue of emerging wildland fire risk due to changes in land uses (former agricultural lands) and make recommendations for wildland fire mitigation.

Molokai: Kawela Gulch and westward

- Coordinate a cooperative program for private-public wildfire response.
- Improve vehicular access in the mauka Kalamaula-Makakupaia areas.
- Intensify fuel reduction mauka of the subdivisions from Makakupaia to Kalamaula. Projects may include constructing fuel breaks and maintaining and intensifying strip grazing.
- Allow for procurement, construction and/or access to open water storage facilities for wildland fire suppression.

Kahikinui

- Develop a coordinated grazing program to reduce wildfire risk.
- Develop a water system to utilize for wildfire response.
- Develop access points for fire fighting vehicles, including heavy equipment.
- Allow for procurement, construction and/or access to open water storage facilities for wildland fire suppression.

Ulupalakua

- Develop a coordinated grazing program to reduce wildfire risk.

- Work with the State to graze agriculture areas not currently under lease agreements.

Maalaea to Ukumehame

- Work with the State to graze agriculture areas not currently under lease agreements.
- Implement a conservation program.
- Reopen access points for fire fighting vehicles.
- Promote fuel reduction in portions of the Ukumehame area.

Kula State Forest Reserve

- Improve vehicular access and maintenance of firebreak access roads in the Kula Forest Reserve.
- Conduct wildland fuel reduction along roads in the Kula Forest Reserve.
- Install portable water storage facilities adjacent to the Kula Forest Reserve during drought conditions.
- Integrate a well-managed grazing program with existing conservation efforts in non-ecologically sensitive areas.

West Maui

- Allow for procurement, construction and/or access to open water storage facilities for wildland fire suppression.
- Provide fuel reduction projects in certain West Maui State Forest parcels via herbicide spray or physical fuel reduction projects.

5.3.2 Agriculture Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to agriculture drought impacts:

Central Maui (HC&S)

- Prioritize maintenance activities during drought periods.
- Prioritize water usage.

Kula, Ulupalakua, Keokea

- Prioritize water usage.
- Construct more surface water storage: lined reservoirs with capacities of 50 to 100 million gallons.
- Improve surface water sources. The County DWS's two upper systems have inadequate surface water intakes.
- Improve transmission systems. If the intakes are upgraded, the transmission system must be upgraded also.

- Develop ground-water sources to supplement the surface water supply during drought.
- Promote education. Expand the water conservation outreach and education program, promote xeriscaping, etc.
- Conduct a review of the current rate structure. Provide ideas for incentives or disincentives to encourage conservation, provide ideas on how to prioritize uses (establish hierarchy of users), etc.
- Continue development of a separate water supply system for agriculture.

Kahikinui

- Extend the current water system or develop a well. Currently, the infrastructure exists, but the water supply was cut off in the 1950s. Electricity for pumping water is an issue, but there may be an opportunity to examine wind energy source.

Hoolehua (Molokai)

- Molokai Irrigation System (MIS) (Hoolehua): Implement recommendations from the Molokai Irrigation System Assessment, State DOA report (June 10, 2004).
- MIS shallow well sources: repair pumps and electrical system (system damaged due to electrical malfunction).
- MIS System Control And Data Acquisition (SCADA) system: Repair and get the monitoring/control system back online.
- Install a pump in Molokai Ranch's Kakalahale cased well. This well could supply high chloride water for mixing with existing sources to meet non-potable water demands.
- Partition the MIS Reservoir to cut down the amount of evaporation and allow blending of high chloride water in certain sections.

5.3.3 Water Supply Mitigation Needs

The committee developed the following list of mitigation projects for areas at risk to water supply drought impacts:

Upcountry Maui (Kula, Makawao, Pukalani to Kaupo)

- There is a need for additional storage. Construct 50 - 100 million gallon lined reservoirs.
- Improve surface water sources. The County DWS's two upper systems have inadequate surface water intakes.
- Improve surface water transmission systems. If the intakes are upgraded, then transmission must also be upgraded.
- Develop ground-water sources. Ground water sources could supplement the surface water supply during periods of drought.

- Education program. Expand the water conservation outreach and education program, promote xeriscaping, etc.
- Conduct a review of the current rate structure. The current water rate structure does not promote conservation. Review the rate structure to provide incentives for conservation. Also, provide ideas on how to prioritize uses (establish hierarchy of users), etc.

Island of Lanai

- Identify alternate sources of water for non-agriculture irrigation on Lanai.

Island of Molokai

- Construct a transmission line that connects the various water supply systems.

6 MAUI COUNTY DROUGHT MITIGATION STRATEGIES

This section summarizes drought mitigation strategies for Maui based on the input received at the workshop. Committee members described existing drought mitigation programs and efforts, and relayed gaps in data and areas where improvements are needed. Areas susceptible to drought were identified, and various projects were proposed to help mitigate future occurrences of drought. Drought-related discussions of programs, concerns, and proposals were organized into the three main categories of impacts: wildland fire, agriculture, and water supply.

The goal of the county drought committee workshop was to brainstorm strategies to guide the identification of future mitigation projects and the formulation of project descriptions. The following sections describe:

- Methodology for Project Prioritization
- “High” Priority Projects
- “Other” Priority projects

6.1 Methodology for Project Prioritization

A prioritization process was undertaken by the Maui Drought Committee to categorize the proposed mitigation projects. This resulted in lists of “high” and “other” priority projects for each impact sector.

Some general guidelines were discussed for consideration during the project prioritization discussion, and are listed below:

- Potential impacts to people;
- Potential impacts to critical natural resources (endangered species habitat, watersheds, cultural resources, erosive soils, etc.);

- Potential impacts to economic resources (jobs, agriculture sector, tax revenues, etc.); and
- Impacts to critical government services (emergency services, water supply, health & human safety).

Generalized timelines were also agreed upon for high priority projects to indicate whether the projects were intended for immediate and/or long-term implementation.

For high priority projects, the Committee members developed detailed project descriptions, utilizing a form developed by the Hawaii Hazard Mitigation Forum. These forms provide project justification and estimated cost information to support the future pursuit of funding and implementation activities. These forms are reproduced in chapter 7.3 of this report and should be updated and revised as more information becomes available.

6.2 Summary of “High” Priority Projects

Summaries of the “high” priority projects for all impact sectors with preliminary cost estimates and general implementation time frames, as voted on and agreed to by the committee, are as follows:

| Maui Drought Committee High Priority Drought Mitigation Projects | | | |
|---|--|--|-------------------------------------|
| Drought Impact Sector | Mitigation Project Description | Preliminary Cost Estimate | Implementation Timeframe |
| Wildland Fire | Improve vehicular access in mauka Kalamaula-Makakupaia and Kula Forest. Improve and maintain about 1 mile of Waipoli Road in Kula Forest and 2 miles of road in the mauka Kalamaula-Makakupaia area. The roads will need to be maintained at least annually and possibly more frequently depending on erosion and vegetation growth. Annual costs will be significantly less once initial improvements are completed. | \$100,000 to \$300,000 | Immediate; Annual maintenance |

| Maui Drought Committee High Priority Drought Mitigation Projects | | | |
|---|---|----------------------------------|---------------------------------|
| Drought Impact Sector | Mitigation Project Description | Preliminary Cost Estimate | Implementation Timeframe |
| | Conservation Management Plan and Implementation. Develop and implement a conservation management plan to reduce wildland fire risk through appropriate best management practices. The plan will cover the subdivisions from Makakupaia to Kalamaula, portions of Ukumehame, Kula State Forest. | \$2 million to \$3 million | Immediate |
| Wildland Fire | Maui Fire Prevention Campaign. Conduct a campaign to educate and inform the public about fire risk and personal responsibilities to reduce fire risk. | \$15,000 annually | Immediate |
| | Procure, construct and provide access to open water storage facilities for wildland fire suppression in west Maui, west Molokai, Kahikinui, and other high-risk areas. | | Immediate; Long-term |
| Agriculture | Molokai Irrigation System Improvements. Implement various initiatives and projects related to restoring the Molokai Irrigation System to full operation and to ensure its long-term reliability. | \$3 million | Immediate; Long-term |
| | Upcountry Maui Agriculture Pipeline Extension. Install a separate agricultural water distribution system to supply untreated water for irrigation purposes to farmers in the Upper Kula area. The water source will be Kahakapao Reservoir. | \$5 million to \$8 million | Long-term |
| | Construct new 100 to 200 MG storage reservoir. Construct an open lined reservoir after the intakes for the Piiholo WTP. The reservoir would provide continuous supply to DWS customers in times of drought. | \$30 million to \$60 million | Long-term |

| Maui Drought Committee High Priority Drought Mitigation Projects | | | |
|---|--|----------------------------------|-----------------------------------|
| Drought Impact Sector | Mitigation Project Description | Preliminary Cost Estimate | Implementation Timeframe |
| Agriculture / Water Supply | Construct new 100 to 200 MG storage reservoir. Construct an open lined reservoir after the intakes for the Piihola WTP. The reservoir would provide continuous supply to DWS customers in times of drought (same as previous project which serves both agriculture and water supply sectors). | \$30 million to \$60 million | Long-term |
| Water Supply | Improve surface water sources in Upcountry Maui. Improve existing intakes to capture a higher percentage of surface water. This may involve adding intakes at known surface sources. The intakes must also be maintained for maximum operational efficiency. | \$5 million to \$10 million | Long-term; Continuous maintenance |
| | Improve surface water transmission system in Upcountry Maui. Improve the surface water transmission system improve the flow of water for agriculture, domestic supply and fire protection. | \$5 million to \$10 million | Long-term |
| | Alternate water sources for non-agriculture irrigation on Lanai. Conduct a feasibility study to determine the most appropriate technology to provide water supply to sustain development on Lanai. | \$3 million to \$6 million | Long-term |

6.3 Summary of “Other” Priority Projects

“Other” priority projects for each sector as voted on and agreed to by the committee are as follows:

| Maui Drought Committee Other Priority Drought Mitigation Projects | |
|--|---|
| Drought Impact Sector | Mitigation Project Description |
| Wildland Fire | Coordinate a cooperative program for private-public wildfire response on Molokai from Kawela Gulch and westward. |
| | Reopen access points for fire fighting vehicles in Maalaea. |
| | Install portable water storage facilities adjacent to the Kula State Forest during drought conditions. |
| | Pursue fuel reduction projects in certain West Maui State Forest parcels via herbicide spray or physical fuel reduction projects. |
| | Form a committee on land use changes. Due to the decline of plantation agriculture, large tracts of fallow agricultural lands can pose a wildland fire risk if vegetation is allowed to become overgrown. |
| Agriculture | Educate water users on water conservation, promote xeriscaping, etc. |
| | Evaluate the DWS water rate structure to provide incentives for water conservation and to establish a hierarchy of water use. |
| | Prioritize maintenance of the surface water system in Central Maui during drought. |
| | Prioritize water use in Central Maui and Kula. |
| | Improve surface water intakes of DWS systems in Kula. |
| | Improve the surface water transmission system in Kula. |
| | Develop groundwater sources in Kula to supplement the surface water system during drought. |
| | Extend the current water system or develop a well in Kahikinui. Currently, the infrastructure exists, but the water supply was cut off in the 1950's. |
| | Install a pump in Molokai Ranch's Kakalahale cased well. This well could supply high chloride water for mixing with existing sources to meet non-potable water demands. |
| | Partition the MIS Reservoir in Hoolehua to cut down the amount of evaporation and allow blending of high chloride water in certain sectors. |
| Water Supply | Develop additional groundwater sources. |
| | Educate water users on water conservation. |
| | Evaluate the DWS water rate structure to provide incentives for water conservation and to establish a hierarchy of water use. |

7 SUMMARY AND RECOMMENDATIONS

Members of the Maui Drought Committee actively participated in a set of facilitated workshop sessions to develop mitigation strategies with the purpose of proactively

addressing the impacts of drought at the County and local level. Representatives from agencies and organizations shared local knowledge and information about current drought conditions, past experiences in dealing with drought, and collectively developed local and regional drought mitigation strategies to minimize the impacts and reduce the risk of drought upon the domestic and municipal water supply, wildland fire-prone areas, agricultural operations, and the environment.

The workshops were successfully concluded with the identification of 10 “High” priority projects, which are categorized as they relate to the major drought impact sectors of wildland fire, agriculture, and water supply. These priority projects can be pursued by the Committee and associated lead agencies for funding for immediate and long-term implementation.

7.1 Recommendations and Issues to Consider in Future Drought Mitigation Planning

The following issues were discussed in the workshops and should be considered in future drought mitigation planning. These recommendations are consistent with the goals and objectives of the Hawaii Drought Plan.

7.1.1 Formalization of Maui Drought Committee

The Maui Drought Committee agreed to convene regular meetings and work towards implementing the priority mitigation projects identified during the workshop process. The Maui drought committee should consider whether it should become a formalized entity.

7.1.2 Project Implementation and Funding Strategy

Project implementation should be focused on those projects that have been identified as having an immediate need and which are most easily achieved. The Maui Drought Committee should seek planning or project funding opportunities through existing government programs, private foundation grants, and county, State, or federal appropriations. Forming partnerships with existing groups (i.e., watershed partnerships, water user cooperatives, etc.) and coordinating mitigation projects will help leverage any funding opportunities or cost-sharing requirements.

7.1.3 Maui Drought Mitigation Strategy Update

This report has been prepared in manner such that it could be readily incorporated into the County of Maui Multi-Hazard Mitigation Plan or function as a stand-alone report. The Maui Drought Committee should work together with the appropriate entities to ensure that this report’s findings are represented in the next revision of the County’s Multi-Hazard Mitigation Plan. This report should be evaluated and updated on a regular basis.

7.1.4 Drought Impact Assessment/Post-drought Evaluation

In order to effectively document the impacts of drought, the Maui Drought Committee should work with the Hawaii Drought Council and the State Drought Coordinator to apply a standardized methodology to document economic, environmental, and social drought impacts. A post-drought evaluation is also recommended to evaluate the efficacy of mitigation and response actions executed by government and private sector organizations, and to make recommendations for improvement.

7.1.5 Drought Response Project Identification

Although this report focuses on preparedness and mitigation, there may be circumstances where emergency assistance is necessary to alleviate drought impacts to stakeholders. Limited federal program funding may be available to help with emergency drought relief. In these cases the Maui Drought Committee should assess and identify these needs within the community and provide a detailed description of drought assistance projects to the State Drought Coordinator, who will submit project proposals from all affected counties for any available federal program assistance.

7.2 Future Maui Drought Committee Operational Activities

The Maui Drought Committee agreed to conduct regular meetings. Critical times for meetings include: 1) December - prior to the Hawaii legislative session and the upcoming Congressional session, and 2) June – just prior to the end of the Federal fiscal year when funds may become available upon short notice. The Committee agreed that Mr. Doug MacCluer will act as chairperson. Members are urged to collaborate on the development of meeting agendas and to share responsibilities for meeting coordination.

7.3 Project Forms

For identified high priority projects, Committee members developed more detailed project descriptions using the format provided by the State Hazard Mitigation Forum. A project form was used to enable consistent project descriptions and includes general project justification and cost information to support the pursuit of project funding and implementation. Specific project details should be developed upon selection of a project for implementation.

The project forms are provided for reference on the following pages. These forms should be updated and revised as more information becomes available.

Index of Project Forms

| | |
|-------------|--|
| WF-1 | Improve vehicular access in mauka Kalamaula-Makakupaia and Kula Forest |
| WF-2 | Conservation Management Plan and Implementation |
| WF-3 | Maui Fire Prevention Campaign |
| WF-4 | Procure, construct and provide access to open water storage facilities for wildland fire suppression in West Maui, West Molokai, Kahikinui and other high risk areas |
| AG-1 | Molokai Irrigation System Improvements |
| AG-2 | Upcountry Maui Agriculture Pipeline Extension |
| AG-3 & WS-1 | Construct New 100 to 200 MG Storage Reservoir |
| WS-2 | Improve Surface Water Sources in Upcountry Maui |
| WS-3 | Improve Surface Water Transmission System in Upcountry Maui |
| WS-4 | Alternate Water Sources for Non-Agriculture Irrigation on Lanai |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WF-1

| | | | |
|--|--|--|-------------------------|
| Jurisdiction: Maui County | | Agency/Organization: DOFAW, the Nature Conservancy, County Fire Dept. | |
| Project Title: Improve vehicular access in mauka Kalamaula-Makakupaia (2 miles) & Kula Forest (1 mile). | | Contact Person: Glenn Shishido | |
| | | Phone: 808-873-3501 | |
| | | e-mail: mafire@aloha.net | |
| Hazard(s): High Fire Risk | | | |
| Flood Zone: NA | | Base Flood Elevation: NA | Erosion Rate: NA |
| Critical Facility/Population/Asset at Risk: Endangered species, prevention of erosion and flooding | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | | <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | | <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | |
| Estimated Cost of Project: \$100,000 to \$300,000 | | Project Period (duration): Annual maintenance | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: Various sources | | | |
| Project Objectives: | | | |
| To improve vehicular access to for fire suppression and to create a fire break for protection of natural resources. | | | |
| Project Description: | | | |
| <p>Improve approximately 1-mile of existing road in the Kula Forest (Waipoli Road). This is an existing public access. The road needs to be maintained at least annually, and possibly more frequently depending on erosion and vegetation growth. Cost estimate for this project is approximately \$100,000. Annual cost would be significantly less once initial improvements are completed.</p> <p>Improve approximately 2-miles of road in the Kalamaula-Makakupaia area. Access would be restricted by landowners and used by DOFAW/the Nature Conservancy/Maui Fire Department for fire suppression and natural resources management. The project needs to be maintained at least annually, and possibly more frequently depending on erosion and vegetation growth. Cost estimate for this project is approximately \$200,000. Annual cost would be significantly less once initial improvements are completed.</p> | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WF-2

| | | | |
|---|------------------------------|--|--|
| Jurisdiction: Maui County | | Agency/Organization: DOFAW, NRCS, FSA, DHHL, SWCD | |
| Project Title: Conservation Management plan and implementation for Makakupaia to Kalamaula, portion of Ukumehame and Kahikinui, and Kula Forest Road. | | Contact Person: Glenn Shishido and Ranae Ganske | |
| | | Phone: Glenn Shishido 873-3501; Ranae Ganske 244-3100 ext. 3 | |
| | | e-mail: mafire@aloha.net (Glenn Shishido) ranae.ganske@hi.usda.gov (Ranae Ganske) | |
| Hazard(s): Fire, mudslides, loss of electricity, road closures | | | |
| Flood Zone: | Base Flood Elevation: | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Highway, Electrical Power Line/ Homeowners, Tourists/ Natural resources and wildlife including endangered species. | | | |
| Environmental Impact: High Medium Low | | Historical Preservation Impact: Questionable due to lack of knowledge regarding the archaeological sites. Bulldozing may alter sites. High Medium Low | |
| Risk of Hazard Impact: High Medium Low | | Importance to Protection of Life and Property and Recovery from Disaster: High Medium Low | |
| Estimated Cost of Project: \$2 to \$3 million for planning and implementation | | Project Period (duration): Year round | |
| Estimated Value of Structure or Facility: There are power lines, reservoirs and delivery system. No estimate of total value. | | | |
| Sources of Financial Support: County, USDA, USFWS, EPA, DOH, DLNR, DHHL | | | |
| Project Objectives: This Management Plan will identify mitigation measures which will reduce the impact of wild land fires through best management practices within Maalaea to Ukumehame Area, Kahikinui, and Kula Forest. | | | |
| Project Description: Division of Forestry and Wildlife(DOFAW), Maui Fire Department (MFD), and Department of Transportation (DOT) will provide technical assistance through the following: <ul style="list-style-type: none"> • Fuel Reduction by grazing management • Partner with MECO and other landowners to implement vegetation management, i.e. 10-foot buffers around all power poles, etc.. • Proposed Subdivision fire mitigation plans through Firewise • Fire prevention Education such as signage and brochures • Maintaining and utilizing and access road firebreaks. • Operation and maintenance for highway Fire Prevention | | | |

Project Description (continued):

USDA- Farm Service Agency (FSA) & Natural Resources Conservation Service will:

- Develop Conservation Plan for landowners and operators.
- Install conservation practices according to NRCS specifications such as Prescribed Grazing, Brush Management, Firebreaks, Fencing Water Facilities, Access Road, and Upland Wildlife Habitat, which include Threatened and Endangered species.
- Cost share may be available through NRCS and FSA
- Emergency Watershed Protection (EWP) which responds to emergencies created by natural disasters

Proposal Date: July 2004

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WF-3

| | | | |
|---|--|---|----------------------|
| Jurisdiction: Maui County | | Agency/Organization: Maui Fire Dept., DOFAW, Community Organizations | |
| Project Title: Maui Fire Prevention Education Campaign | | Contact Person: County Fire Chief | |
| | | Phone: 808-270-7561 | |
| | | e-mail: | |
| Hazard(s): Fire | | | |
| Flood Zone: | | Base Flood Elevation: | Erosion Rate: |
| Critical Facility/Population/Asset at Risk: All of Maui County | | | |
| Environmental Impact: High Medium Low | | Historical Preservation Impact: High Medium Low | |
| Risk of Hazard Impact: High Medium Low | | Importance to Protection of Life and Property and Recovery from Disaster: High Medium Low | |
| Estimated Cost of Project: \$15,000 annually | | Project Period (duration): On-going | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: County Fire Dept, DOFAW, other fire organizations, community groups | | | |
| Project Objectives: Create an educated and informed public concerning Maui County fire risk and personal responsibilities to reduce such risk. | | | |
| Project Description: Invigorate current fire education and outreach program to reach a greater number of Maui County residents through a more disciplined and organized fashion. During fire seasons and periods of drought, the campaign should be customized to represent the risk and threat to residents. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WF-4

| | | | |
|--|------------------------------|--|--|
| Jurisdiction: County of Maui | | Agency/Organization: DOFAW, DHHL, Ulupalakua Ranch | |
| Project Title: Procure, construct and provide access to open water storage facilities (reservoirs) for wildland fire suppression areas in the West Maui (former cane lands), west Molokai, Kahikinui, and other high risk areas | | Contact Person: Sumner Erdman, George Maioho (DHHL Molokai) | |
| | | Phone: Sumner Erdman 878-1202 George Maioho 560-6104 | |
| | | e-mail: | |
| Hazard(s): Wildland fire suppression | | | |
| Flood Zone: | Base Flood Elevation: | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Residences, telecommunication towers, power lines, natural resources | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| High Medium Low | | High Medium Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| High Medium Low | | High Medium Low | |
| Estimated Cost of Project: (to be provided by contacts) | | Project Period (duration): | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: grants, Tri-Isle RC&D, County funds, OHA | | | |
| Project Objectives: Develop new water storage facilities and reservoirs for wildland fire suppression activities. | | | |
| Project Description: Inventory sites for possible reservoir development suitable for helicopter and/or vehicle access. After the inventory has been completed, develop sites based upon accessibility for fire equipment access. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: AG-1

| | | | |
|--|--|--|--|
| Jurisdiction: Maui County (Molokai) | | Agency/Organization: HDOA/ARMD | |
| Project Title: Molokai Irrigation System Improvements | | Contact Person: Brian Kau | |
| | | Phone: 808-973-9473 | |
| | | e-mail: brian.k.kau@hawaii.gov | |
| Hazard(s): Drought | | | |
| Flood Zone: | | Base Flood Elevation: | |
| | | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Irrigation water to the farmers of the Molokai Irrigation System. This is the largest state-owned water irrigation system. Supplies a significant portion of irrigation water on Molokai. | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| High Medium Low | | High Medium Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| High Medium Low | | High Medium Low | |
| Estimated Cost of Project: \$3 Million | | Project Period (duration): 2 years (estimate) | |
| Estimated Value of Structure or Facility: \$120,000,000 | | | |
| Sources of Financial Support: State of Hawaii | | | |
| Project Objectives: Improve the Molokai Irrigation System with respect to emergency, life/safety, reliability, and maintenance issues. | | | |
| Project Description: Conduct various initiatives and projects related to restoring the Molokai Irrigation System to full operation and ensuring its long-term reliability. Some initiatives will address immediate operational deficiencies such as recent electrical malfunctions that have led to pump failures. Another sub-project may improve maintenance infrastructure and equipment, such as access roads, tunnel lighting, etc. Life/safety issues, such as exposed high voltage power lines and warning signs, must also be addressed. Finally, an ongoing repair and maintenance program must be developed and implemented to reduce the likelihood of future catastrophic system failures. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: AG-2

| | | | |
|--|--|--|----------------------|
| Jurisdiction: Maui County | | Agency/Organization: HDOA/ARMD | |
| Project Title: Upcountry Maui Agriculture Pipeline Extension | | Contact Person: Brian Kau | |
| | | Phone: 808-973-9473 | |
| | | e-mail: brian.k.kau@hawaii.gov | |
| Hazard(s): Drought | | | |
| Flood Zone: | | Base Flood Elevation: | Erosion Rate: |
| Critical Facility/Population/Asset at Risk: | | | |
| Reduce the risk of drought to farmland, reduce treatment cost, and reduce potable water demand in Upcountry Maui. | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| High Medium Low | | High Medium Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| High Medium Low | | High Medium Low | |
| Estimated Cost of Project: \$5 to \$8 Million | | Project Period (duration) 3 years | |
| Estimated Value of Structure or Facility: \$20,000,000 | | | |
| Sources of Financial Support: NRCS, State of Hawaii | | | |
| Project Objectives: | | | |
| Provide affordable irrigation water to the Upper Kula Farmers and increase irrigation water availability and reliability. | | | |
| Project Description: | | | |
| This project proposes the installation of a separate agricultural water distribution system to supply untreated water for irrigation purposes to farmers in the Upper Kula area. The water source will be Kahakapao Reservoir. The main distribution pipeline will extend from Olinda to Keokea with nine lateral systems serving the areas of Olinda, Crater Road, Kimo Road, Pulehuiki/Kamehameiki, Kealahou, Waiakoa, Kaonoulou, Waiohuli, Keokea/DHHL. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: AG-3 & WS-1

| | | | |
|---|--|--|--|
| Jurisdiction: Maui County | | Agency/Organization: Department of Water Supply | |
| Project Title: Construct new 100 – 200 MG storage reservoir | | Contact Person: Larry Winter | |
| | | Phone: 270-7835 | |
| | | e-mail: larry.winter@maui.co.hi.us | |
| Hazard(s): Drought | | | |
| Flood Zone: | | Base Flood Elevation: | |
| | | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Upcountry water using population, both agricultural and domestic water users (about 25,000+ people). | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| High Medium Low | | High Medium Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| High Medium Low | | High Medium Low | |
| Estimated Cost of Project: \$30 to \$60 Million | | Project Period (duration): 10+ years | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: Federal grants/state loans/County funds | | | |
| Project Objectives: To reduce the impacts of drought on upcountry farmers and residents. | | | |
| Project Description: Construct an open lined reservoir after the intakes for the Piiholo WTP. This reservoir would be sized to minimize drought and provide continuous supply to DWS customers in times of drought. The transmission line to feed the reservoir is an existing line and the reservoir would be along that alignment. A Preliminary Engineering Study for the project is being prepared. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WS-2

| | | | |
|---|------------------------------|---|--|
| Jurisdiction: Maui County | | Agency/Organization: Department of Water Supply | |
| Project Title: Improve surface water sources in upcountry Maui | | Contact Person: Jeff Pearson | |
| | | Phone: 270-7834 | |
| | | e-mail: jeff.pearson@co.maui.hi.us | |
| Hazard(s): Drought | | | |
| Flood Zone: | Base Flood Elevation: | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Upcountry water system, resident population of 25,000+ | | | |
| Environmental Impact: <div> <div>High</div> <div>Medium</div> <div>Low</div> </div> | | Historical Preservation Impact: <div> <div>High</div> <div>Medium</div> <div>Low</div> </div> | |
| Risk of Hazard Impact: <div> <div>High</div> <div>Medium</div> <div>Low</div> </div> | | Importance to Protection of Life and Property and Recovery from Disaster: <div> <div>High</div> <div>Medium</div> <div>Low</div> </div> | |
| Estimated Cost of Project: \$5 to \$10 Million | | Project Period (duration): continuous | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: Fed. Loans/State loans/County funds | | | |
| Project Objectives: To increase or improve source water (surface) for the upcountry system. This will increase the available water to minimize drought impacts | | | |
| Project Description: Improve existing intakes to capture a higher percentage of surface water. This may involve adding intakes at known surface sources. The intakes must also be maintained to enable optimal operational efficiency. A preliminary project assessment will be prepared to develop project costs and specifications. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WS-3

| | | | |
|--|--|--|--|
| Jurisdiction: Maui County | | Agency/Organization: Department of Water Supply | |
| Project Title: Improve surface water transmission system in Upcountry Maui | | Contact Person: Jeff Pearson | |
| | | Phone: 270-7834 | |
| | | e-mail: jeff.pearson@co.maui.hi.us | |
| Hazard(s): Drought | | | |
| Flood Zone: | | Base Flood Elevation: | |
| | | Erosion Rate: | |
| Critical Facility/Population/Asset at Risk: Upcountry system and population, farming and water supply, 25,000+ population. | | | |
| Environmental Impact: | | Historical Preservation Impact: | |
| <input checked="" type="radio"/> High <input checked="" type="radio"/> Medium <input type="radio"/> Low | | <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | |
| Risk of Hazard Impact: | | Importance to Protection of Life and Property and Recovery from Disaster: | |
| <input checked="" type="radio"/> High <input type="radio"/> Medium <input type="radio"/> Low | | <input type="radio"/> High <input checked="" type="radio"/> Medium <input type="radio"/> Low | |
| Estimated Cost of Project: \$5,000,000 to \$10,000,000 | | Project Period (duration): Ongoing CIP projects | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: State loans/ County loans and funds | | | |
| Project Objectives: | | | |
| To improve the surface water transmission system to improve the flow of water for agriculture, domestic supplies, and fire protection. | | | |
| Project Description: | | | |
| Systematically improve the existing surface water transmission system by replacing existing lines or installing new lines. | | | |
| Proposal Date: July 2004 | | | |

MAUI DROUGHT MITIGATION PROJECT IDENTIFICATION FORM: WS-4

| | | | |
|---|----------------------------------|---|--------------------------|
| Jurisdiction: Maui County (Lanai) | | Agency/Organization: Castle & Cooke Resorts (Lanai Co.) | |
| Project Title: Alternate water sources for non-agriculture irrigation on Lanai | | Contact Person: Collins Lam | |
| | | Phone: (808) 565-3352 | |
| | | e-mail: collinsl@lanai-resorts.com | |
| Hazard(s): Drought | | | |
| Flood Zone: N/A | Base Flood Elevation: N/A | | Erosion Rate: N/A |
| Critical Facility/Population/Asset at Risk: Manele Golf Course, Manele Project District | | | |
| Environmental Impact: High Medium Low | | Historical Preservation Impact: High Medium Low | |
| Risk of Hazard Impact: High Medium Low | | Importance to Protection of Life and Property and Recovery from Disaster: High Medium Low | |
| Estimated Cost of Project: \$3,000,000 to \$6,000,000 | | Project Period (duration) 3 - 5 years | |
| Estimated Value of Structure or Facility: | | | |
| Sources of Financial Support: Private and government grants | | | |
| Project Objectives: To sustain irrigation water supply for Manele Project District as housing development increases in order to mitigate drought impacts to the irrigated landscape areas. This would reduce the demand placed on potable water supply. | | | |
| Project Description: As housing development increases at the Manele Project District, more water is required for irrigation of lawn and common areas. The Manele Project District cannot use potable water for landscape irrigation. Alternate sources will need to be evaluated in order to sustain development. Among the alternatives is desalination using reverse osmosis units and electrodialysis (EDR). A feasibility study is required to determine the most logical technology to select. | | | |
| Proposal Date: July 2004 | | | |

8 REFERENCES

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Hawaii Drought Plan*. Prepared by Wilson Okamoto Corporation, December 2004.

State of Hawaii, Department of Land and Natural Resources, Commission on Water Resource Management. *Drought Risk and Vulnerability Assessment and GIS Mapping Project*. Prepared by University of Hawaii, Social Science Research Institute, September 2003.

State of Hawaii, Department of Defense, Civil Defense Division. *State of Hawaii Hazard Mitigation Plan*. Draft, December 2004.

State of Hawaii, Department of Agriculture. *Agricultural Water Use and Development Plan*. Draft, December 2003.